"INTERTEMPORAL PRICES AND THE US TRADE BALANCE IN DURABLE GOODS"

by

Michael BURDA*
and
Stefan GERLACH**

N° 89 / 31

* Assistant Professor of Economics, INSEAD, Boulevard de Constance, 77305 Fontainebleau, France

** Brandeis University, Waltham, MA 02254 USA

Director of Publication:

Charles WYPLOSZ, Associate Dean for Research and Development

Printed at INSEAD, Fontainebleau, France

Intertemporal Prices and the US Trade Balance in Durable Goods

Michael C. Burda*

Stefan Gerlach**

July 1989

* INSEAD, F-77305 Fontainebleau, FRANCE.

** Brandeis University, Waltham, MA 02254, USA.

An earlier version of this paper was entitled "Durables and the US Trade Deficit." The paper was written while Gerlach was visiting INSEAD. We would like to acknowledge the helpful comments of seminar participants in Paris (SEMI), Geneva (IUHEI), Tilburg (CentER), and the Business Economics Seminar at INSEAD, as well as of Roger Betancourt, Slobodjan Djajic, Hans Genberg, Mervyn King, Charles Wyplosz, Bob Stern, and Walter Wasserfallen. Burda acknowledges the support of INSEAD's Research Department. The usual disclaimer applies.

JEL numbers 431, 441; Keywords: durable goods, trade balance, intertemporal prices

Abstract

This paper shows that virtually all of the US trade deficit since 1982 can be attributed to the deterioration of the trade balance in *durable* goods, rather than in nondurables. Moreover, the deficit is concentrated on capital goods rather than consumer durables or autómobiles. Using a simple model, we show that the trade balance on durables depend critically on intertemporal prices. This results suggests that the deficit on durables may be due to a reduction of their intertemporal prices associated with, among other things, the temporary appreciation of the dollar in the early 1980s. The key role of intertemporal prices is confirmed by our econometric findings.

1. Introduction

The purpose of this paper is to review and account for an important aspect of the US trade deficit which has received relatively little attention in the literature. Since 1982, virtually all of the deterioration of the US merchandise trade balance can be accounted for by the trade balance in durable goods, defined as capital goods, automobiles, consumer durables, and durable industrial supplies. Furthermore, at least half of the US durables trade deficit in the early 1980s can be explained by a large increase in imports of capital goods since 1982. While other components of the durable trade balance--automobiles, consumer and industrial durables--also deteriorated, these components are dwarfed by the capital goods component.

The very different behavior of durable and nondurable goods is interesting for several reasons. First, it casts doubts on the traditional "consumption-binge" explanation of the US merchandise trade deficit. For instance, if the deficit is largely due to a consumption boom fueled by high aggregate demand, the trade balance should worsen predominantly in the consumption goods sector, i.e., consumer durables and nondurables. In fact, the worsening of the trade balance in consumer durables is much less pronounced than in capital goods, whereas the worsening in consumer nondurables is unremarkable compared with previous expansions. Second, the composition of the trade balance may be of importance when designing appropriate policy responses. For instance, if the trade deficit is largely due to imports of nondurable consumption goods, import-reducing policies may be more appropriate than if instead the deficit is attributable to firms' purchases of investment goods. Third, the distinction between durable and nondurable goods is of economic significance. When goods are durable, the timing of purchases appears as an additional decision variable. Consequently, a temporary reduction in the price of durables --caused for example by an exchange rate appreciation which is expected to reverse itself-- will have a larger effect on the durable goods trade balance than a permanent price change. This is true because the former affects both current relative and intertemporal prices, while the latter affects only current relative prices.[1]

To account for the markedly different behavior of the disaggregated trade balances, in Section 3 we propose a simple two-period optimizing model of the current account that emphasizes the difference between durable and nondurable goods. We study the

---

[1] For a general discussion of the impact on the trade balance of intertemporal price changes following a devaluation, see Gerlach (1989).

responses of the trade balances in durables and non-durables to changes in relative prices, other determinants of permanent income, and the intertemporal price of durables. While the trade balances in both nondurable and durable goods depend on relative prices and permanent income, we show that the trade balance in durable goods also depends on *intertemporal prices*. In periods in which current prices are low relative to expected future prices, the model predicts the trade balance in durable goods to worsen more then the trade balance on nondurables.

In Section 4 we turn to the econometric evidence. Clearly, for the model to have empirical content, the data should reveal an intertemporal reallocation response of the durables trade balance to changes in intertemporal prices. The demonstration of such an effect could help explain the persistence of the current US trade imbalance after the dollar depreciation in 1985-1986, since import prices were slow to respond if at all (Baldwin 1988). The results indicate that intertemporal price movements are indeed an important determinant of both real durables imports and the trade balance in durable goods. In the final section, Section 5, we summarize the implications of our findings.

2. Durables vs. Non-Durables

To illustrate the strikingly different roles of durables and nondurables goods in the US trade deficit, Figure 1 disaggregates real US merchandise trade account as a percentage of GNP into three components: (1) oil and petroleum products; (2) non-oil industrial and consumer nondurable goods; and (3) durable goods as defined by the US Commerce Department, including industrial durables, capital goods, and consumer durables.[2] The figure reveals several interesting facts. While imports of petroleum products increased from about 1.5% of GNP in 1970 to as much as 4% of GNP in 1977, they have been remarkably constant at about 2% of GNP during the 1982-88 period. It is evident that the deterioration of the trade balance beginning in 1982 can be attributed to durable goods; from a surplus of roughly 1% of GNP in 1980, the durables trade balance deteriorates rapidly after

---

[2] Nondurables include food and foodstuffs, grains and feeds, beverages, textile products, paper and paper-based products, chemicals, non-metal-related industrial supplies (nonoil imports and exports in 1988 equalled $114.9 and $115.6 billions respectively). Durables include metal-related industrial supplies; electrical and electronic, industrial, construction and textile machinery; business and office machines; computers and related equipment; scientific and professional equipment; telecommunications equipment; transportation equipment, automotive vehicles including engines, parts and accessories; aircraft and parts; radios, televisions, and other household appliances (imports and exports in 1988 equalled $295.2 and $201.3 billions respectively). See September issues of _Survey of Current Business_.

1982 with the deficit eventually reaching 2.5% of GNP in 1986. In contrast, the decline of the non-oil nondurable goods trade balance since 1982 is not remarkable given the historical experience (about 0.5% of GNP). Finally, while the trade balance on durables and nondurables both improve over the 1986-88 period, the improvement is again concentrated in durable goods.

Table 1 displays annual growth rates of exports and imports of durables in volume terms since 1980. It is evident that the worsening in the trade deficit on durables is primarily associated with a surge of imports between 1982-84 (cumulatively 60.1% in real terms). In addition, durable exports declined sharply in 1982 and have only recently recovered; indeed most of the improvement of trade balance in durables since 1986 can be attributed to strong export growth rather than a reduction in imports.

Disaggregation of the durables account reveals further surprises. Figure 2 plots the four most important components of durable merchandise trade as a fraction of real GNP: industrial durables, capital goods, automobiles, and consumer durables. At least half of the behavior of US durables trade deficit in the early 1980s can be explained by the substantial worsening in the trade balance on capital goods, which historically has been a surplus account. In general, the extent of deterioration appears to be inversely proportional to the durability; the most significant movements are in the capital goods sector, followed by cars, consumer durables, and industrial durables.

The dominant role of capital goods is poorly accounted for by the standard view associating the deterioration of US trade deficit with a consumption binge. In this view, expansionary fiscal policy combined with myopic or liquidity-constrained consumers induced rapid growth and a rise in imports.[3] One of the problems with relying solely on movements in real GNP to explain the asymmetric behavior of durables and nondurables in Figure 1 is that implausibly high income elasticities of durables goods demand are required to generate the observed large increase in imports since 1982.[4]

The different behavior of durables and nondurable goods trade balances in the data has economic content. In the next section we analyze a simple model in which the durability of goods plays a key role. The central conclusion in this section is that the

---

[3] See for example the textbook discussion of Dornbusch and Fischer (1987) or Krugman and Obstfeld (1988). Recently McKinnon (1988) has used this argument to support his proposals for a return to fixed exchange rates.

[4] The simple regression on quarterly data from 1967:2 to 1981:4

$$m_t = a_0 + a_1 m_{t-1} + a_2 y_t + a_3 y_{t-1} + u_t$$

where m and y denote respectively logarithms of real imports and real GNP, yielded a long-run elasticity of 2.1 for durables (1.7 for non-durables), well below the value required to link the observed 26.2% real GNP growth over 1982:1-88:3 with a 122.5% increase in real durable imports.

demand for durable goods is affected by both intertemporal prices as well as current relative prices. The possibility of intertemporal reallocation of purchases introduces a important difference between the theoretical behavior of the durables and nondurable trade balances.

3. A Simple Model

In this section we analyze the determination of the durable and nondurable trade balance using a modified version of Sachs' (1981) model of the current account. The purpose of the model is to highlight the importance of intertemporal prices for the two trade balances. Since we are interested in understanding the consequences of such price movements -- and not their causes -- we undertake a partial equilibrium analysis with prices taken by agents as given.[5] Moreover, we intentionally disregard the short-run determination of the current account and instead focus on its medium to long-run determination.

For simplicity, we consider a two-period economy with preferences of a representative agent who consumes two types of goods. The first, denoted by C, is strictly nondurable and must

---

[5] Although it is indeed interesting to understand the pricing behavior of exporters to the United States, our objective is to assess the optimal reaction of consumers given this pricing behavior.

be consumed in the current period. The second, the stock of which is denoted D, is strictly durable and lasts for both periods.[6] Utility of the representative agent is given by her consumption of nondurables and, as in Mankiw (1987) her *stock* of durables, i.e.,

$$U = C_1^{\theta} D_1^{(1-\theta)} [C_2^{\theta} D_2^{(1-\theta)}]^{\beta} \tag{1}$$

where the subscripts denote the period of consumption (i.e., $i=1,2$) and $0<\beta<1$ is the discount factor. After logarithmic transformation, this utility function is time-separable and represents a special case of a more general (nested) CES function. In order to assess the role of durability in a balanced way, we have intentionally chosen the above utility function since it constrains the intertemporal elasticity of substitution to be unity, i.e., income and substitution effects exactly cancel.

The economy's production possibility frontier is given by

$$Q_i^C = (Z_i K_i^{\alpha} - Q_i^D)^{\gamma} \qquad 0<\alpha,\gamma<1 \tag{2}$$
$$Q_i^C,\ Q_i^D \geq 0$$

where Q^C and Q^D are (nonnegative) quantities produced of the

---

[6] While an important element of a multiperiod setup, depreciation of the durable stock adds little insight to the current analysis and is ignored.

durable and nondurable goods respectively, K is the economy-wide capital stock which is implicitly assumed to be perfectly fungible in production, and Z is an economy-wide shift term to the production function, which may represent technological progress but could also capture the effects of taxes on net proceeds from market activity to the representative agent.[7]

Durables can either be used in the production of goods or durable consumption services. The inherited stock of consumer durables D_1 and productive capital K_1 can be augmented with purchases of durable goods in period 1, I_1^D and I_1^K respectively. The evolution of the capital and durable stocks are described by

$$K_2 = K_1 + I_1^K \tag{3}$$

$$D_2 = D_1 + I_1^D \tag{4}$$

The economy can trade its output on a world market at prices p_1^C, p_1^D, p_2^C, p_2^D, *which it takes as parametric.* At the end of the economy's life the capital and durable stocks are assumed to have zero liquidation value. The *intertemporal* budget constraint can be written as

---

[7]The production possibilities frontier model can be derived from a two-sector setting with perfect capital mobility and fixed labor supply.

$$B_1 + p_1^C(Q_1^C - C_1) + p_1^D(Q_1^D - I_1^D - I_1^K) + (1+r)^{-1}[p_2^C(Q_2^C - C_2) + p_2^D Q_2^D] \geq 0 \qquad (5)$$

where B_1 is the nominal stock of financial wealth "inherited" at the beginning of period 1 and r is the nominal rate of interest for both borrowing and lending. The inequality (5) requires that the present value of trade surpluses plus initial wealth equal or exceed zero. Alternatively, the present value of consumption and investment expenditures cannot exceed the present value of production plus initial financial wealth.

The problem of the representative agent is to maximize (1) with respect to C_1, C_2, I_1^D, I_1^K, Q_1^C, Q_2^C, Q_1^D, and Q_2^D subject to the production possibilities frontier in (2) in each period, the transition equations (3) and (4), and the intertemporal wealth constraint (5). Substitution of equations (2) and (3) into (5) and (4) into (1) simplifies the problem to that of choosing C_1, C_2, I_1^D, I_1^K, Q_1^D, and Q_2^D, to maximize

$$U = C_1^{\theta} D_1^{(1-\theta)} [C_2^{\theta}(D_1 + I_1^D)^{(1-\theta)}]^{\beta}$$

subject to Q_1^C, Q_2^C, Q_1^D, and Q_2^D nonnegative, D_1 and K_1 given, and

$$\begin{aligned} B_1 &+ p_1^C((Z_1 K_1^{\alpha} - Q_1^D)^{\gamma} - C_1) + p_1^D(Q_1^D - I_1^D - I_1^K) + \\ &(1+r)^{-1}[p_2^C((Z_2(K_1 + I_1^K)^{\alpha} - Q_2^D)^{\gamma} - C_2) + p_2^D Q_2^D] \geq 0. \end{aligned}$$

The optimum must satisfy the following first order conditions:

$$U\theta/C_1=\lambda p_1^C \tag{6.1}$$

$$U\beta\theta/C_2=\lambda p_2^C(1+r)^{-1} \tag{6.2}$$

$$U(1-\theta)/D_1=\lambda p_1^D \tag{6.3}$$

$$p_2^C Z_2\alpha\gamma(Z_2K_2^\alpha-Q_2^D)^{\gamma-1}K_2^{\alpha-1}(1+r)^{-1} = p_1^D \tag{6.4}$$

$$p_1^C\gamma(Z_1K_1^\alpha-Q_1^D)^{\gamma-1} = p_1^D \tag{6.5}$$

$$p_2^C\gamma(Z_2K_2^\alpha-Q_2^D)^{\gamma-1} = p_2^D \tag{6.6}$$

where λ is the Lagrangian multiplier associated with the intertemporal budget constraint and can be thought of as the marginal utility of wealth. These first order conditions have the usual interpretations: equations (6.1)-(6.3) are inter- and intratemporal efficiency conditions with respect to consumption, equation (6.4) is an intertemporal efficiency condition for investment, and equations (6.5) and (6.6) are intratemporal efficiency conditions for domestic production. Combined with (5) which holds with equality, we have a system of seven equations in seven unknowns.

Since (6.4), (6.5) and (6.6) can be solved for I_1^K, Q_1^D, and Q_2^D independently of C_1, C_2, and I_1^D, a separation of production and consumption decisions obtains. As in Sachs (1982), this follows from a time-separable utility specification which excludes leisure. We can therefore write the optimal production plans for i=1,2 *given* the capital stock K_i as

$$Q_i^{D*} = \begin{cases} 0 & \text{if } Z_i K_i^{\alpha} \le (p_i^C \gamma / p_i^D)^{1/(1-\gamma)} \\ Z_i K_i^{\alpha} - (p_i^C \gamma / p_i^D)^{1/(1-\gamma)} & \text{otherwise,} \end{cases} \tag{7}$$

and

$$Q_i^{C*} = \begin{cases} Z_i K_i^{\alpha} & \text{if } Z_i K_i^{\alpha} \le (p_i^C \gamma / p_i^D)^{1/(1-\gamma)} \\ (p_i^C \gamma / p_i^D)^{\gamma/(1-\gamma)} & \text{otherwise.} \end{cases} \tag{8}$$

Next, substitute Q_2^{D*} into (6.4) and rearrange to obtain optimal investment in period 1:

$$I_1^{K*} = K_2 - K_1 = [p_2^D Z_2 \alpha / (p_1^D (1+r))]^{1/(1-\alpha)} - K_1 . \tag{9}$$

Solution for the consumption side of the model proceeds as follows. First substitute optimal production and investment in equations (7), (8) and (9) into the intertemporal budget constraint; write (6.1)-(6.3) in terms of C_1 and substitute these into (5); finally solve for C_1, C_2, and I_1^D. For an interior production solution in both periods (absence of complete specialization) we have

$$C_1 = \theta W / p_1^C (\theta+\beta) \tag{10}$$

$$C_2 = \theta W\beta(1+r)/p_2^C(\theta+\beta) \tag{11}$$

$$I_1^D = D_2 - D_1 = (1-\theta)W\beta/p_1^D(\theta+\beta) - D_1 \tag{12}$$

where wealth W is defined as

$$\begin{aligned} W = {} & B_1 + p_1^D(K_1+D_1) + p_1^C(p_1^C\gamma/p_1^D)^{\gamma/(1-\gamma)} \\ & + p_1^D\left[Z_1K_1^\alpha - (p_1^C\gamma/p_1^D)^{1/(1-\gamma)} - [p_2^DZ_2\alpha/(p_1^D(1+r))]^{1/(1-\alpha)}\right] \\ & + (1+r)^{-1}\left\{p_2^C(p_2^C\gamma/p_2^D)^{\gamma/(1-\gamma)}\right. \\ & \left. + p_2^D\left[Z_2[p_2^DZ_2\alpha/p_1^D(1+r)]^{\alpha/(1-\alpha)} - (p_2^C\gamma/p_2^D)^{1/(1-\gamma)}\right]\right\} \end{aligned} \tag{13}$$

or simplifying using (7), (8) and (9),

$$W = B_1 + p_1^D(K_1+D_1) + p_1^CQ_1^{C*} + p_1^D(Q_1^{D*} - I_1^{K*}) + (1+r)^{-1}(p_2^CQ_2^{C*} + p_2^DQ_2^{D*}) \tag{14}$$

where $Q_2^{D*} = Z_1(K_1+I_1^*)^\alpha - (p_2^C\gamma/p_2^D)^{1/(1-\gamma)}$. Wealth may be thought of as the discounted value of disposable resources available to agents who efficiently exploit available economic opportunities. Note that W includes the inherited stock of capital, K_1, and durables, D_1, as well as financial wealth, B_1. Note also that due to the assumption of unit intertemporal elasticity of substitution, the demand for durable goods for consumption purposes depends on wealth only. With a more general CES utility function, an elasticity of substitution greater than unity would also link shifts in consumer durables purchases to intertemporal prices.

The central expressions for the trade balances of nondurable and durable goods can now be derived. Following Sachs (1982) we implicitly define permanent income y^P as a constant income stream with present discounted value W, so $y^P=(1+r)/(2+r)W$. We consider only interior solutions for production, so real trade balances in the first period are given by

$$
\begin{aligned}
TB_1^C &\equiv (Q_1^C-C_1) \\
&= (p_1^C\gamma/p_1^D)^{\gamma/(1-\gamma)} - [\phi\theta/(\theta+\beta)]y^P/p_1^C
\end{aligned}
\tag{15}
$$

$$
\begin{aligned}
TB_1^D &\equiv (Q_1^D-I_1^K-I_1^D) \\
&= \Big\{[Z_1K_1^{\alpha}-(p_1^C\gamma/p_1^D)^{1/(1-\gamma)}] \\
&\qquad -[p_2^DZ_2\alpha/(p_1^D(1+r))]^{1/(1-\alpha)}] \\
&\qquad -[\phi(1-\theta)\beta/(\theta+\beta)]y^P/p_1^D\Big\} + (K_1+D_1)
\end{aligned}
\tag{16}
$$

where $\phi=(2+r)/(1+r)$.

The interpretation of equations (15) and (16) are straightforward. First, both trade balances depend on the current relative price of durables. An increase in the price of durables relative to nondurables improves the durable good trade balance, and worsens the trade balance on nondurables. Second, both trade balances depend negatively on permanent income, y^P. It should be remarked that movements in y^P may be associated with either current observables or future variables which are unobservable in the first period. Third, only the durables trade balance depends on the *intertemporal* price of durables as captured by $p_2^D(1+r)^{-1}/p_1^D$. This result is interesting since it suggests that a temporary reduction in current prices relative to future prices, caused by an exchange rate appreciation, may have a larger effect on the durable goods trade balance then on the trade balance on non-durables.[8]

One can exploit equations (15) and (16) to analyze the effects of changes in various forcing variables. Consider first a permanent reduction in p^D, i.e., for both periods. This might correspond to an increase in world supply, a decrease in price per quality-unit, or a permanent change in markup behavior by importers. From (15), the response of the nondurables trade balance is unambiguously positive: increased current domestic production is reinforced by decreased consumption stemming from a decline in y^P.[9] From (16), the response of the durables trade

---

[8]For a discussion of this phenomenon in Latin American countries, see Dornbusch (1988).

[9]This result obtains by application of the envelope theorem to

balance is ambiguous: current domestic production falls, but the decline in permanent income may offset it, depending on parameter values and initial conditions. Generally, economies with large initial endowments, strong preferences for durables, or production concentrated in nondurables, will tend to show an improvement in the durables trade balance.[10]

Next consider the effect of a decline in the intertemporal price of durables, which might result from an increase in p_2^D, an decrease in p_1^D, or a decline in r. We consider only the first two possibilities. In the former case, the first period nondurables trade balance is affected to the extent that wealth W rises (increased investment leads to increased production in the second period), whereas the durables balance in addition is driven by an increased demand for investment goods. The demand for consumer durables increases to the extent that permanent income rises.[11] In

---

(13): $\partial W^P/\partial p^D = K_1 + D_1 + Q_1^{D*} - I_1^{K*} + (1+r)^{-1} Q_2^{D*}$, which is negative only in the implausible case of $I_1^{K*} > K_1 + D_1 + Q_1^{D*} + (1+r)^{-1} Q_2^{D*}$.

[10] If we differentiate the trade balance with respect to durables prices, $\partial TB^D/\partial p^D = -[1/(1-\gamma)](p_1^C \gamma / p_1^D)^{1/(1-\gamma)}/p_1^D + [(1-\theta)\beta/(\theta+\beta)] [B_1 + p_1^C Q_1^{C*} + (1+r)^{-1}(p_2^C Q_2^{C*})]/(p_1^D)^2$ which has an ambiguous sign.

[11] Recall that due to the structure of the model, the economy can produce both types of good in the second period, but will produce durables only for export.

contrast, a temporary decline in durables prices will induce increases in both nondurable and durable consumption in both periods. The net effect on the nondurable trade balance is ambiguous, while the balance in durables deteriorates as the decline in domestic production reinforces an increase in current as well as intertemporal speculative demand.

Finally we assess the effect of an exogenous increase in Z_i, which from (13) will increase national wealth and thus permanent income. From equations (15) and (16) it follows that an increase in permanent income will increase consumption demand for both nondurables and durables. This translates directly into a worsening deficit in both goods, since period 1 production is given. However, in the case of higher Z_i, the deterioration will be stronger in durables since investment demand will also rise.

Summary

The analysis above is compatible with the following "medium run" interpretation of the trade deficit in the 1980s: the tax cuts and the decline in oil prices (higher Z_1, Z_2 or possibly both) led to an increase in permanent wealth, and increased desired imports of durables for investment purposes. In addition, the decline in real oil prices may also have increased W via Z, although this might be offset by a wealth effect given the large oil reserves of the US.[12] To the extent that durables are more extensively traded, the appreciated dollar of 1982-85 led to lower relative prices of imported durables, which further stimulated imports. However, the above analysis suggests an additional channel by which the high dollar affected the trade balance: the movements of intertemporal prices. The temporary appreciation of the dollar depressed current prices of imported durables (p_1^D) relative to their expected future values (p_2^D). For a given nominal interest rate, the real rate of interest for durables fell, which stimulated additional purchases of durables.[13]

4. Evidence for the model

In this section we offer some empirical evidence on the role of intertemporal prices in the the trade balance on durables. Before turning to econometrics, consider the time series plots of *ex post* intertemporal prices and the trade balance on durables in Figure 3.[14] There is a strong positive relationship between the two

---

[12] It is revealing to review the trade balance during the sharp increases in real oil prices in the 1970s, when durables went into surplus (see Figure 1).

[13] Over the period 1982:1-1987:4, the price deflators of investment goods and consumer durables rose by 1.1% and 10.1% respectively, whereby the GNP deflator rose by 23.6%.

[14] As explained in the text below, the intertemporal price is calculated as the nominal interest rate (at time t) on one-year government bonds minus the percentage increase of the prices of

series: when intertemporal prices are high (such as in 1974-75, and 1980-81) the durable goods trade balance is in surplus, while when intertemporal prices are relatively low (1976-77 and 1984-85), the trade balance turns increasingly negative. Thus, our theory seems as a first pass not inconsistent with the data. What is required, of course, is a multivariate analysis which we pursue below.

4.1 Econometric Evidence

Although our theoretical model implies tight testable relationships between the trade balance, relative price variables, and permanent income, we eschew estimation of the underlying structural parameters. While we believe that the model captures important regularities in the data, it is unlikely that our specification of underlying utility and production functions are literally correct. Thus, if we were to estimate the underlying parameters of the model, we would expect it to be rejected by the data. This rejection would not be very informative, since it might originate in a host of econometric problems, such as aggregation of heterogeneous agents, lags in responses due to adjustment costs, or specification error. For this reason, we prefer to

---

imported durable goods between t and t+4.

investigate and describe the dynamic relationships in the data, rather than to estimate and test a specific structural model.

Below we estimate the following "standard" trade balance and import demand equations using data on the real trade balance as a fraction of GNP (denoted TB_t^d), the log of real imports of durables (m_t^d), the log of (our proxy for) permanent income (y_t^P), the log of relative prices (p_t^x/p_t^m), and the intertemporal price of imports (q_t):[15,16]

$$A(L)m_t^d = B(L)y_t^P + C(L)(p_t^x/p_t^m) + D(L)E_tq_t + E(L)\varepsilon_t^1 \qquad (17a)$$

$$\tilde{A}(L)TB_t^d = \tilde{B}(L)y_t^P + \tilde{C}(L)(p_t^x/p_t^m) + \tilde{D}(L)E_tq_t + \tilde{E}(L)\varepsilon_t^2 \qquad (17b)$$

where A(L), B(L), C(L), D(L) and E(L) are polynomials in the lag operator, and ε_t^i denotes an error term, which may be serially correlated. The term $E_tq_t = r_t - E_t(\ln(p_{t+4}^m) - \ln(p_t^m))$ measures the *ex ante* real interest rate, which is our measure of the anticipated intertemporal price of imported durables. Thus, an

---

[15] All data were obtained from DRI's data bank, which originate from the Department of Commerce (*Survey of Current Business*) or the International Monetary Fund (*International Financial Statistics*. They are available from the authors on request.

[16] See Goldstein and Khan (1985) for a review of empirical work on the determination of the trade balance.

increase in $E_t q_t$ should improve the trade balance by reducing import demand.

A central element in the above analysis is that the intertemporal price of imported durables (i.e., the real interest rate calculated using import prices for durables) is to some extent predictable using current information. One way of finding an empirical analogue to $E_t q_t$ is to estimate jointly with (17) a prediction equation for intertemporal prices

$$q_t = F(L)x_t + \varepsilon_t \tag{18}$$

where F(L) is a matrix polynominal in the lag operator, and x_t a vector of data, effectively imposing $E_t q_t = \hat{F}(L)x_t$. This is the strategy we pursue here.[17]

Since we are interested in forecasts of intertemporal prices, any variable observed at t is a potential candidate for inclusion in x_t. After some experimentation we settled on the following specification:

$$q_t = \phi_1 r_t + \phi_2(p^x_{t-1}/p^m_{t-1}) + \phi_3(p^m_t/p^m_{t-4}) + \phi_4(p^m_{t-1}/p^m_{t-5}) + \varepsilon_t \tag{19}$$

---

[17]This approach of embedding the rational expectations hypothesis in a joint system of estimating equations was developed by Mishkin (1983).

where (p^m_t/p^m_{t-4}) measures the rate of price increase for imported durable over the last 4 quarters, and where, potentially, the error term may obey some ARMA process.[18]

Given our argument that exchange rate changes through some pass-through relationship generate movements in $E_t q_t$, it may be surprising that the exchange rate does not enter the price prediction equation above. In order to link exchange rate changes to movements in expected intertemporal prices, a model of price behavior of US importers is required, as well as foreign durable goods price index. While the issues raised by markup behavior are crucial to understanding to the response of the trade balance to depreciations (see Mann 1986, Baldwin 1988, and Rose and Yellen 1989) at this stage we take price behavior as given to US consumers, postponing such an exercise for future work.

Preliminaries

The transition from our suggestive theoretical model to a system of estimating equations requires some discussion. First, in the theoretical model in which domestic and foreign durable goods are perfect substitutes, the relevant relative price is given by p^c_t/p^d_t. For the episode under study, however, it is more realistic

---

[18] In the empirical work we use log fourth differences to measure the rate of price increase for imported durables.

to consider a terms-of-trade variable measured using durables goods prices, i.e., p^x_t/p^m_t, as the relevant relative price. For this reason we use this variable in the estimations below. Second, since permanent income is unobservable, a suitable proxy must be found. Given the long literature initiated by Hall (1978) on consumption and permanent income --which argues that current consumption is approximately linear in the permanent income-- we use non-durable domestic consumption as a proxy for permanent income.

An additional problem, discussed by Rose and Yellen (1989), concerns the relation between the type of nonstationarity in the data and choice of estimation strategy. Briefly, equations (17) and (18) should only be estimated using level data if the raw data is stationary. If the data are non-stationary, the equations should either be estimated in first-difference form, or (if the data is non-stationary and cointegrated) within the framework of an error-correction model.[19] For this reason, before estimating the import and trade equations, we tested for the presence of unit roots and potential cointegration. Briefly, the results suggested that the data were non-stationary, but not cointegrated.[20] We thus

---

[19]See Engle and Granger (1987) and Stock (1987) for discussions of these issues.

[20]The results for the Augmented Dickey-Fuller (ADF) tests (with 4

estimate the trade equations and the price prediction equations in first-difference form.

Results

The first set of estimates for real durable imports (i.e., (17a)-(19)) are presented in Table 2, and the results for the durable goods trade balance (i.e., (17b)-(19)) in Table 3. The equations are estimated jointly alternately by nonlinear least squares, with and without instrumental variables.[21] There is some question of the endogeneity of current relative import/export

---

lags) using data spanning 1971:2-1987:3 were: for the trade balance ADF=1.29; for permanent income, ADF=2.39; for intertemporal prices, ADF=1.60; relative prices, ADF=2.99, for the interests rate, ADF=1.76; and for import prices of durables, ADF=1.95. Critical values for a test at the 10 percent (5 percent) level are 2.60 (2.93) for 50 observations and 2.58 (2.89) for 100 observations. All time series, except possibly relative prices, should thus be viewed as non-stationary.

We next tested for cointegration among the different series. The ADF test for a system consisting of the trade balance, permanent income and intertemporal prices resulted in a statistic of 1.71. Adding relative price to the system yielded a ADF statistic of 1.82. Critical values for ADF tests against the hypothesis of no cointegration are 3.73 for the three variable system, and 3.89 for the four variable system (for 100 observations and at the ten percent level, see Engle and Yoo 1987, p. 157). Thus the variables do not appear to be cointegrated.

[21] Instruments were all the right hand side variables except current relative prices, and current real GNP/GDP growth in Canada, France, Germany, Japan and the UK. The forecasting equation was estimated once lagged, in order to allow all right hand side variables to be used as instruments.

durable prices as measured by p_t^x/p_t^m. Even if US consumers and producers take prices as given, the way in which price indices are constructed may lead to joint endogeneity with imports.[22] Using a Hausman test however, we were unable to reject the exogeneity of p_t^x/p_t^m in the trade balance equation ($\chi^2(1)=0.51$).[23] For the reader who doubts the exogeneity of relative prices, we present both NL3SLS and NLS estimates.

The results show a consistent and powerful role of ex ante intertemporal prices in the import equation.[24] As expected, the sign is negative in the durables import equation and positive in the trade balance equation. The estimates are robustly estimated and generally highly statistically signficant.[25] The magnitudes of the estimates suggest that a one percentage point decrease in the

---

[22] If real durable imports are measured as a Paasche index with base year prices, then the implicit price deflator will be by construction correlated with the quantity measure.

[23] In the import equation, the Hausman test statistic was negative (-4.48), an unfortunate result of working with finite data samples.

[24] This is consistent with unreported but equally robust results using ex post intertemporal prices.

[25] Formal tests of the constraint that $\beta_0=\beta_1=\beta_2=0$ in the equations estimated by NLS rejected the hypothesis ($\chi^2(3)=17.92$ for imports of durables and $\chi^2(3)=8.13$ for the trade balance on durables).

intertemporal price of durable goods will lead to roughly a 1.4% percent increase in the level of real durable imports as well as a deterioration of the durables trade balance of about 0.5% of GNP. To get an idea of relative magnitudes, the ex post intertemporal price in Figure 3 has a standard deviation of 8.6 in the levels and 2.9 in the first differences; in the period 1984-86, the variable dropped by 12 percentage points, which our estimates would associate with an increase in real durable imports of about 18% and a deterioration of the deficit by 6% of GNP.

Turning briefly to the other variables, we see that increases in permanent income tends increase the demand for imports of durables and to worsen the trade balance. Similarly, a reduction in the relative price of imported durables increases imports and worsens the trade balance. The results for intertemporal prices as well as for permanent income and relative prices are quite insensitive to the exact specification of the model. On the whole, the equations fit the data quite well and the results are encouraging for the model presented above. The residuals are well-behaved as evidenced by the relatively low Q-statistics even at long lags.

As described above, the forecasting function of the intertemporal price of durables was embedded in the model. However, it could be claimed that the variables employed in the price prediction equation might enter the "structural" equations for other reasons than their role in forecasting intertemporal prices. To ascertain the validity of our specification, we tested the cross-equation restrictions implied by the model, employing the criterion described by Gallant and Jorgenson (1979). Our results were encouraging: we cannot reject the validity of the restrictions at the 95% level for either durables imports ($\chi^2(16)=11.31$) or the durables trade balance ($\chi^2(16)=25.92$).

5. Concluding Comments

In this paper we have shown that the deterioration of the US trade balance since the early 1980s is strongly concentrated in durable goods, in particular capital goods. Moreover, our simple theoretical model indicates that the main analytical difference between the determination of the durable and nondurable goods trade balance is that the former depends on intertemporal prices, or the own real rate of interest.

It is widely recognized that conventionally estimated equations of the aggregate US merchandise trade balance have performed poorly in recent years. Most significantly, they have consistently underpredicted the US trade deficit since 1982. This apparent breakdown of traditional relationships has motivated several new approaches to the trade balance determination based, among other things, on monopolistic competition and fixed costs (Krugman and Baldwin 1987 or Baldwin 1988), voluntary import restrictions, or import spillovers in a disequilibrium model (Bean, Drèze, and Layard 1989). Our results suggest that intertemporal prices should play a central theoretical role in durable goods flows and that there is ample evidence to support to this prediction. More generally, the behavior of durable goods has been quite different from that of non-durables, so that the standard aggregation of non-durables and durables usually found in the literature may be ill-advised.

References

Barro, R., "The Ricardian Approach to Budget Deficits," National Bureau of Economic Research Working Paper No 2685, August 1988.

Baldwin, R. "Hysteresis in Import Prices: The Beachhead Effect," American Economic Review 78 (September 1988), 773-785.

Bean, C., J. Drèze, and R. Layard, Europe's Unemployment Problem, forthcoming, MIT Press 1989.

Dornbusch R., "Our LDC Debts ," in M. Feldstein, ed., The United States in the World Economy (University of Chicago Press, Chicago, 1988).

_________, and S.Fischer, Macroeconomics, Fourth International Edition (New York: McGraw-Hill, 1987).

Engle, R. and C. Granger, "Cointegration and Error Correction: Representation, Estimation and Testing," Econometrica, 1987, 55, 251-276.

Engle, R. and B. Yoo, "Forecasting and Testing in Co-Integrated Systems," Journal of Econometrics, 1987, 35, 143-159.

Gallant, R. and D. Jorgenson, "Statistical Inference for a System of Simultaneous, Non-linear, Implicit Equations in the Context of Instrumental Variable Estimation," Journal of Econometrics, 1979, 11, 275-302.

Gerlach, S. "Intertemporal Speculation, Devaluation, and the 'J-Curve,'" forthcoming in the Journal of International Economics, 1989.

Goldstein, M., and M.Khan, "Income and Price Effects in Foreign Trade," Chapter 20 in R.Jones and P.Kenen, eds Handbook of International Economics, vol II, (Amsterndam: Elsevier Science Publishers 1985), 1041-1105.

Hall, R. "Stochastic Implication of the Life Cycle-Permanent Income Hypothesis: Theory and Evidence." Journal of Political Economy 86, 1978.

Helkie, W. L. and P. Hooper, "An Empirical Analysis of the External Deficit." In R. Bryant et. al., eds., External

Deficits and the Dollar, Brookings Institution, Washington D.C., 1988.

Krugman,P., and R. Baldwin, "Persistence of the US Trade Deficit," Brookings Papers on Economic Activity 1:1987, 1-43.

Krugman, P. and M. Obstfeld, International Economics (Glennview, USA: Scott Foresman, Inc. 1988).

Mann, K., (1986) "Prices, Profit Margins, and Exchange Rates," Federal Reserve Bulletin 72, 366-379.

Mankiw, G., "Government Purchases and Real Interest Rates," Journal of Political Economy, 95 (1987), 407-419.

McKinnon, R. "Monetary and Exchange Rate Policies for International Financial Stability: A Proposal," Journal of Economic Perspective 2 (Winter 1988) 83-103.

Mishkin, F., A Rational Expectations Approach to Macroeconometrics (Chicago, University of Chicago Press, 1983).

Rose, A. and J. Yellen "Is there a J-Curve?" forthcoming in the Journal of Monetary Economics, 1989.

Sachs, J. "The Current Account and Macroeconomic Adjustment in the the 1970s," BPEA 1:1981, 201-268.

__________, "The Current Account in the Macroeconomic Adjustment Process," Scandinavian Journal of Economics, 84, 1982, 147-159.

Stock, J., "Asymptotic Properties of Least Squares Estimators of Cointegrating Vectors," Econometrica, 1987, 55, 1035-1056.

TABLE 1.
Real Growth in Imports and Exports 1980-1988
(% per annum, year over year change)

	Durable Goods		Nonoil Nondurable Goods	
	Exports	Imports	Exports	Imports
Year				
1980	9.8	0.3	12.6	-6.3
1981	-4.1	8.6	2.9	10.1
1982	-15.2	-0.6	-2.6	4.4
1983	-1.9	20.0	-4.5	13.3
1984	10.6	34.0	4.0	19.8
1985	8.6	8.5	-3.9	4.1
1986	6.2	10.4	3.5	7.5
1987	16.2	7.8	13.0	5.5
1988	27.7	8.8	11.9	-0.6

TABLE 2.

Joint Estimates of Import and Price Prediction Equations

1970:1-1987:3

Model:

(A) $\Delta m^d_t = \alpha_1 \Delta m^d_{t-1} + \alpha_2 \Delta m^d_{t-2} + \beta_0 \Delta y^P_t + \beta_1 \Delta y^P_{t-1} + \beta_2 \Delta y^P_{t-2} + \theta \Delta(p^x_t/p^m_t) + \gamma_0 E_t \Delta q_t + \gamma_1 E_{t-1} \Delta q_{t-1} + \gamma_2 E_{t-2} \Delta q_{t-2} + \varepsilon^1_t$

(B) $\Delta q_t = \alpha_1 \Delta r_t + \alpha_2 \Delta(p^x_{t-1}/p^m_{t-1}) + \alpha_3 \Delta(p^m_t/p^m_{t-4}) + \alpha_4 \Delta(p^m_{t-1}/p^m_{t-5}) + \varepsilon^2_t$

$$\varepsilon^2_t = \omega\varepsilon^2_{t-1} + v_t$$

where, by assumption

$$E_t q_t \equiv \phi_1 \Delta r_t + \phi_2 \Delta \ln(p^x_{t-1}/p^m_{t-1}) + \phi_3 \Delta \ln(p^m_t/p^m_{t-4}) + \phi_4 \Delta \ln(p^m_{t-1}/p^m_{t-5}) + \omega\varepsilon^2_{t-1}$$

Results

Technique:	NLS		NL3SLS	
α_1	$.329\times10^{-1}$	(.112)	$.514\times10^{-1}$	(.124)
α_2	$.448\times10^{-1}$	(.106)	$.702\times10^{-1}$	(.115)
β_0	$-.489\times10^{-1}$	(.689)	$.287\times10^{-1}$	(.721)
β_1	1.442**	(.707)	1.593**	(.751)
β_2	.410	(.718)	.465	(.768)
θ	.543*	(.296)	1.072*	(.541)
γ_0	$.159\times10^{-2}$	$(.316\times10^{-1})$	$.253\times10^{-2}$	$(.403\times10^{-2})$
γ_1	$-.496\times10^{-2}$*	$(.293\times10^{-2})$	$-.347\times10^{-2}$	$(.330\times10^{-2})$
γ_2	$-.103\times10^{-1}$***	$(.319\times10^{-2})$	$-.111\times10^{-1}$***	$(.368\times10^{-2})$

TABLE 2.
(continued)

ϕ_1	.917***	(.193)	.996***	(.203)
ϕ_2	.241**	(.113)	.252**	(.112)
ϕ_3	.537***	$(.950 \times 10^{-1})$	.534***	$(.976 \times 10^{-1})$
ϕ_4	-.424***	$(.918 \times 10^{-1})$	-.423***	$(.950 \times 10^{-1})$
ω	.463***	$(.970 \times 10^{-1})$	.513***	(.177)

Equation:	A.	B.	A.	B.
Q-stat.				
4 lags	9.0	1.7	8.1	2.1
8 lags	14.8	4.5	13.4	10.2
12 lags	16.3	12.1	14.4	11.7
DW	2.01	1.89	2.10	1.96
SE	.0389	2.059	.0400	2.063

Log likelihood: -22.32 NA

Notes: Asymptotic standard errors in parentheses, *,**,*** denotes significance at the (10,5,1) percent level. The constants in both equations have been suppressed. The Q-statistic is distributed as chi-squared with degrees of freedom depending on the number of lags: critical values at the 5 percent level for (4,8,12) lags are (9.5,15.5,21.0). The instrument list for the NL3SLS results includes all right-hand side variables (except current relative prices) and current GNP/GDP growth in Canada, France, Germany, Japan and the UK.

TABLE 3.

Joint Estimates of Trade Balance and Price Prediction Equations

1970:1-1987:3

Model:

(A) $$\Delta TB^d_t = \alpha_1 \Delta TB^d_{t-1} + \alpha_2 \Delta TB^d_{t-2} + \beta_0 \Delta y^P_t + \beta_1 \Delta y^P_{t-1} + \beta_2 \Delta y^P_{t-2} + \theta\Delta(p^x_t/p^m_t) + \gamma_0 E_t \Delta q_t + \gamma_1 E_{t-1}\Delta q_{t-1} + \gamma_2 E_{t-2}\Delta q_{t-2} + \varepsilon^1_t$$

(B) $$\Delta q_t = \alpha_1 \Delta r_t + \alpha_2 \Delta(p^x_{t-1}/p^m_{t-1}) + \alpha_3 \Delta(p^m_t/p^m_{t-4}) + \alpha_4 \Delta(p^m_{t-1}/p^m_{t-5}) + \varepsilon^2_t$$

$$\varepsilon^2_t = \omega\varepsilon^2_{t-1} + v_t$$

where, by assumption

$$E_t q_t \equiv \phi_1 \Delta r_t + \phi_2 \Delta \ln(p^x_{t-1}/p^m_{t-1}) + \phi_3 \Delta \ln(p^m_t/p^m_{t-4}) + \phi_4 \Delta \ln(p^m_{t-1}/p^m_{t-5}) + \omega\varepsilon^2_{t-1}$$

Results

Technique:	NLS		NL3SLS	
α_1	.238**	(.106)	.227**	(.108)
α_2	.217**	(.105)	.228**	(.108)
β_0	$-.751\times10^{-1}$	$(.428\times10^{-1})$	$-.728\times10^{-1}$	$(.438\times10^{-1})$
β_1	$-.202\times10^{-2}$	$(.448\times10^{-1})$	$-.940\times10^{-2}$	$(.468\times10^{-1})$
β_2	$.263\times10^{-1}$	$(.438\times10^{-1})$	$.245\times10^{-1}$	$(.459\times10^{-1})$
θ	$-.672\times10^{-1}$***	$(.182\times10^{-1})$	$-.901\times10^{-1}$***	$(.314\times10^{-1})$
γ_0	$.695\times10^{-5}$	$(.188\times10^{-3})$	$-.845\times10^{-4}$	$(.234\times10^{-3})$
γ_1	$.369\times10^{-3}$**	$(.188\times10^{-3})$	$.311\times10^{-3}$	$(.202\times10^{-3})$
γ_2	$.197\times10^{-3}$	$(.188\times10^{-3})$	$.367\times10^{-3}$*	$(.208\times10^{-3})$

TABLE 3.
(continued)

ϕ_1	1.01***	(.201)	1.04***	(.199)
ϕ_2	.190	(.119)	.234**	(.117)
ϕ_3	.520***	$(.973\times10^{-1})$	.528***	$(.993\times10^{-1})$
ϕ_4	-.393***	$(.956\times10^{-1})$	-.414***	$(.979\times10^{-1})$
ω	.438***	(.100)	.574***	(.173)

Equation:	A.	B.	A.	B.
Q-stat.				
4 lags	2.6	1.8	2.4	2.7
8 lags	6.4	9.6	5.5	10.3
12 lags	9.2	11.3	7.9	11.9
DW	1.86	1.84	1.87	2.04
SE	.0024	2.051	.0024	2.081
Log likelihood	175.63		NA	

Notes: Asymptotic standard errors in parentheses, *,**,*** denotes significance at the (10,5,1) percent level. The constants in both equations have been suppressed. The Q-statistic is distributed as chi-squared with degrees of freedom depending on the number of lags: critical values at the 5 percent level for (4,8,12) lags are (9.5,15.5,21.0). The instrument list for the NL3SLS results includes all right-hand side variables (except current relative prices) and current GNP/GDP growth in Canada, France, Germany, Japan and the UK.

Fig. 11 Components of the US Merchandise Trade Balance, 1967-1988 (Percent of GNP)

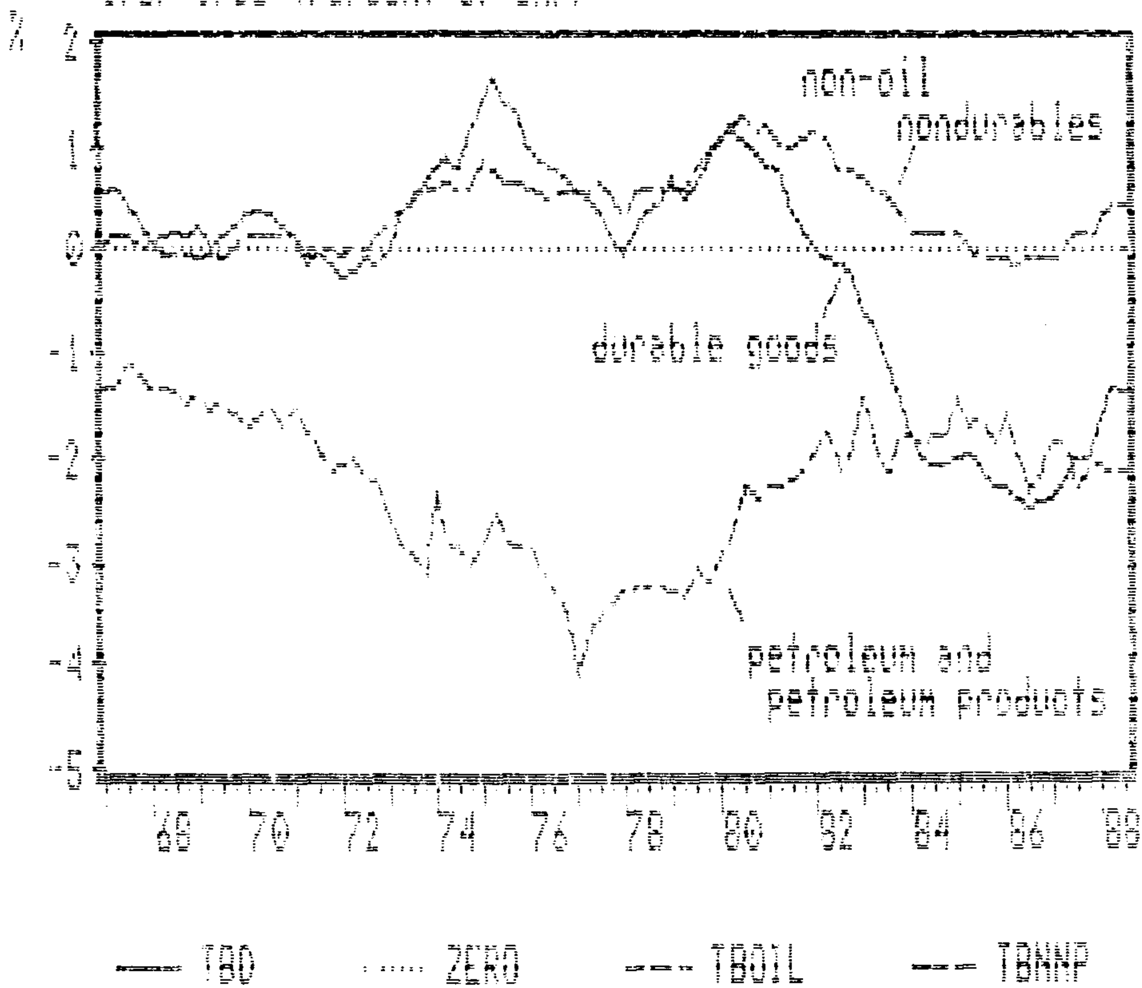


Fig. 2: Components of the US Durable Merchandise Trade Balance, 1967-1988 (Percent of GNP)

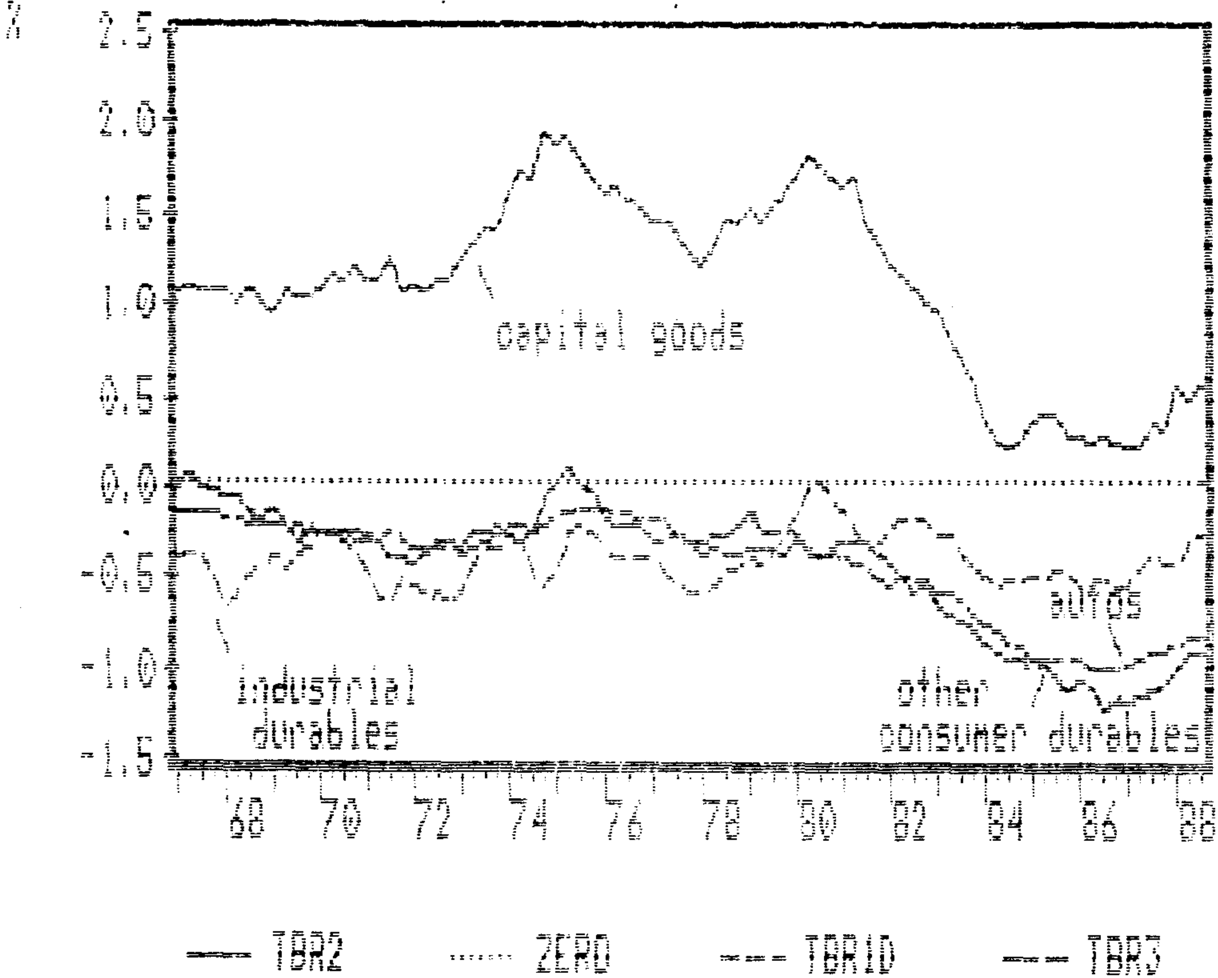
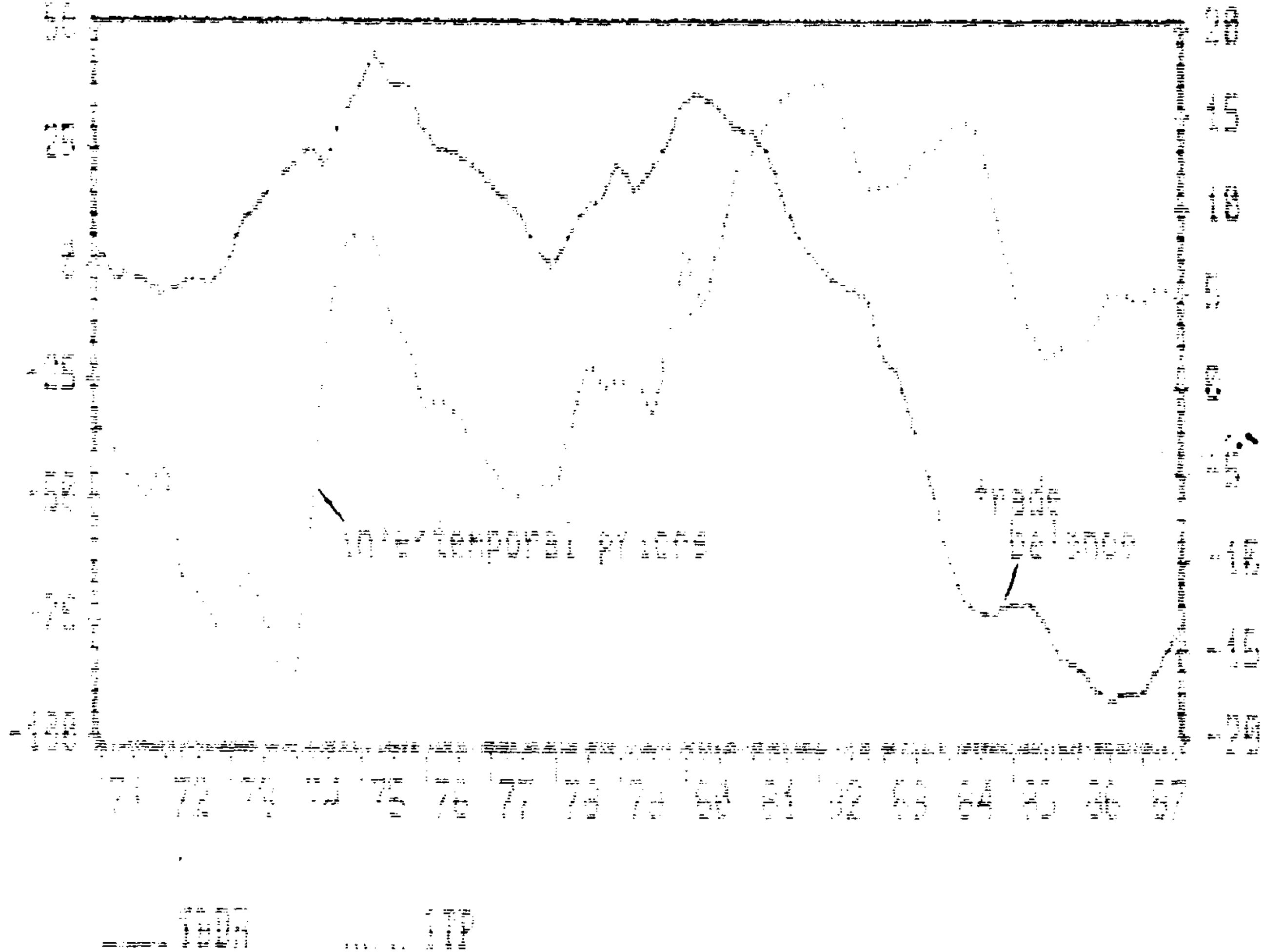


Fig. 3: Trade Balance on Durables (in Billion US Dollars) and Intertemporal Prices of Imported Durables (in Percent)



INSEAD WORKING PAPERS SERIES

1986

86/01	Arnoud DE MEYER	"The R & D/Production interface".
86/02	Philippe A. NAERT Marcel WEVERBERGH and Guido VERSWIJVEL	"Subjective estimation in integrating communication budget and allocation decisions: a case study", January 1986.
86/03	Michael BRIMM	"Sponsorship and the diffusion of organizational innovation: a preliminary view".
86/04	Spyros MAKRIDAKIS and Michèle HIBON	"Confidence intervals: an empirical investigation for the series in the M-Competition" .
86/05	Charles A. WYPLOSZ	"A note on the reduction of the workweek", July 1985.
86/06	Francesco GIAVAZZI, Jeff R. SHEEN and Charles A. WYPLOSZ	"The real exchange rate and the fiscal aspects of a natural resource discovery", Revised version: February 1986.
86/07	Douglas L. MacLACHLAN and Spyros MAKRIDAKIS	"Judgmental biases in sales forecasting", February 1986.
86/08	José de la TORRE and David H. NECKAR	"Forecasting political risks for international operations", Second Draft: March 3, 1986.
86/09	Philippe C. HASPESLAGH	"Conceptualizing the strategic process in diversified firms: the role and nature of the corporate influence process", February 1986.
86/10	R. MOENART, Arnoud DE MEYER, J. BARBE and D. DESCHOOLMEESTER.	"Analysing the issues concerning technological de-maturity".
86/11	Philippe A. NAERT and Alain BULTEZ	"From "Lydiametry" to "Pinkhamization": misspecifying advertising dynamics rarely affects profitability".
86/12	Roger BETANCOURT and David GAUTSCHI	"The economics of retail firms", Revised April 1986.
86/13	S.P. ANDERSON and Damien J. NEVEN	"Spatial competition à la Cournot".
86/14	Charles WALDMAN	"Comparaison internationale des marges brutes du commerce", June 1985.
86/15	Mihkel TOMBAK and Arnoud DE MEYER	"How the managerial attitudes of firms with FMS differ from other manufacturing firms:
86/16	B. Espen ECKBO and Herwig M. LANGOHR	"Les primes des offres publiques, la note d'information et le marché des transferts de contrôle des sociétés".
86/17	David B. JEMISON	"Strategic capability transfer in acquisition integration", May 1986.
86/18	James TEBOUL and V. MALLERET	"Towards an operational definition of services", 1986.
86/19	Rob R. WEITZ	"Nostradamus: a knowledge-based forecasting advisor".
86/20	Albert CORHAY, Gabriel HAWAWINI and Pierre A. MICHEL	"The pricing of equity on the London stock exchange: seasonality and size premium", June 1986.
86/21	Albert CORHAY, Gabriel A. HAWAWINI and Pierre A. MICHEL	"Risk-premia seasonality in U.S. and European equity markets", February 1986.
86/22	Albert CORHAY, Gabriel A. HAWAWINI and Pierre A. MICHEL	"Seasonality in the risk-return relationships some international evidence", July 1986.
86/23	Arnoud DE MEYER	"An exploratory study on the integration of information systems in manufacturing", July 1986.
86/24	David GAUTSCHI and Vithala R. RAO	"A methodology for specification and aggregation in product concept testing", July 1986.
86/25	H. Peter GRAY and Ingo WALTER	"Protection", August 1986.
86/26	Barry EICHENGREEN and Charles WYPLOSZ	"The economic consequences of the Franc Poincare", September 1986.
86/27	Karel COOL and Ingemar DIERICKX	"Negative risk-return relationships in business strategy: paradox or truism?", October 1986.
86/28	Manfred KETS DE VRIES and Danny MILLER	"Interpreting organizational texts.
86/29	Manfred KETS DE VRIES	"Why follow the leader?".
86/30	Manfred KETS DE VRIES	"The succession game: the real story.
86/31	Arnoud DE MEYER	"Flexibility: the next competitive battle", October 1986.
86/31	Arnoud DE MEYER, Jinichiro NAKANE, Jeffrey G. MILLER and Kasra FERDOWS	"Flexibility: the next competitive battle", Revised Version: March 1987
86/32	Karel COOL and Dan SCHENDEL	Performance differences among strategic group members", October 1986.

86/33	Ernst BALTENSPERGER and Jean DERMINE	"The role of public policy in insuring financial stability: a cross-country, comparative perspective", August 1986, Revised November 1986.
86/34	Philippe HASPESLAGH and David JEMISON	"Acquisitions: myths and reality", July 1986.
86/35	Jean DERMINE	"Measuring the market value of a bank, a primer", November 1986.
86/36	Albert CORHAY and Gabriel HAWAWINI	"Seasonality in the risk-return relationship: some international evidence", July 1986.
86/37	David GAUTSCHI and Roger BETANCOURT	"The evolution of retailing: a suggested economic interpretation".
86/38	Gabriel HAWAWINI	"Financial innovation and recent developments in the French capital markets", Updated: September 1986.
86/39	Gabriel HAWAWINI Pierre MICHEL and Albert CORHAY	"The pricing of common stocks on the Brussels stock exchange: a re-examination of the evidence", November 1986.
86/40	Charles WYPLOSZ	"Capital flows liberalization and the EMS, a French perspective", December 1986.
86/41	Kasra FERDOWS and Wickham SKINNER	"Manufacturing in a new perspective", July 1986.
86/42	Kasra FERDOWS and Per LINDBERG	"FMS as indicator of manufacturing strategy", December 1986.
86/43	Damien NEVEN	"On the existence of equilibrium in hotelling's model", November 1986.
86/44	Ingemar DIERICKX Carmen MATUTES and Damien NEVEN	"Value added tax and competition", December 1986.

1987

87/01	Manfred KETS DE VRIES	"Prisoners of leadership".
87/02	Claude VIALLET	"An empirical investigation of international asset pricing", November 1986.
87/03	David GAUTSCHI and Vithala RAO	"A methodology for specification and aggregation in product concept testing", Revised Version: January 1987.
87/04	Sumantra GHOSHAL and Christopher BARTLETT	"Organizing for innovations: case of the multinational corporation", February 1987.
87/05	Arnoud DE MEYER and Kasra FERDOWS	"Managerial focal points in manufacturing strategy", February 1987.
87/06	Arun K. JAIN, Christian PINSON and Naresh K. MALHOTRA	"Customer loyalty as a construct in the marketing of banking services", July 1986.
87/07	Rolf BANZ and Gabriel HAWAWINI	"Equity pricing and stock market anomalies", February 1987.
87/08	Manfred KETS DE VRIES	"Leaders who can't manage", February 1987.
87/09	Lister VICKERY, Mark PILKINGTON and Paul READ	"Entrepreneurial activities of European MBAs", March 1987.
87/10	André LAURENT	"A cultural view of organizational change", March 1987
87/11	Robert FILDES and Spyros MAKRIDAKIS	"Forecasting and loss functions", March 1987.
87/12	Fernando BARTOLOME and André LAURENT	"The Janus Head: learning from the superior and subordinate faces of the manager's job", April 1987.
87/13	Sumantra GHOSHAL and Nitin NOHRIA	"Multinational corporations as differentiated networks", April 1987.
87/14	Landis GABEL	"Product Standards and Competitive Strategy: An Analysis of the Principles", May 1987.
87/15	Spyros MAKRIDAKIS	"METAFORECASTING: Ways of improving Forecasting. Accuracy and Usefulness", May 1987.
87/16	Susan SCHNEIDER and Roger DUNBAR	"Takeover attempts: what does the language tell us?, June 1987.
87/17	André LAURENT and Fernando BARTOLOME	"Managers' cognitive maps for upward and downward relationships", June 1987.
87/18	Reinhard ANGELMAR and Christoph LIEBSCHER	"Patents and the European biotechnology lag: a study of large European pharmaceutical firms", June 1987.
87/19	David BEGG and Charles WYPLOSZ	"Why the EMS? Dynamic games and the equilibrium policy regime, May 1987.
87/20	Spyros MAKRIDAKIS	"A new approach to statistical forecasting", June 1987.
87/21	Susan SCHNEIDER	"Strategy formulation: the impact of national culture", Revised: July 1987.
87/22	Susan SCHNEIDER	"Conflicting ideologies: structural and motivational consequences", August 1987.
87/23	Roger BETANCOURT David GAUTSCHI	"The demand for retail products and the household production model: new views on complementarity and substitutability".

87/24	C.B. DERR and André LAURENT	"The internal and external careers: a theoretical and cross-cultural perspective", Spring 1987.
87/25	A. K. JAIN, N. K. MALHOTRA and Christian PINSON	"The robustness of MDS configurations in the face of incomplete data", March 1987, Revised: July 1987.
87/26	Roger BETANCOURT and David GAUTSCHI	"Demand complementarities, household production and retail assortments", July 1987.
87/27	Michael BURDA	"Is there a capital shortage in Europe?", August 1987.
87/28	Gabriel HAVAVINI	"Controlling the interest-rate risk of bonds: an introduction to duration analysis and immunization strategies", September 1987.
87/29	Susan SCHNEIDER and Paul SHRIVASTAVA	"Interpreting strategic behavior: basic assumptions themes in organizations", September 1987
87/30	Jonathan HAMILTON V. Bentley MACLEOD and J. F. THISSE	"Spatial competition and the Core", August 1987.
87/31	Martine QUINZII and J. F. THISSE	"On the optimality of central places", September 1987.
87/32	Arnoud DE MEYER	"German, French and British manufacturing strategies less different than one thinks", September 1987.
87/33	Yves DOZ and Amy SHUEN	"A process framework for analyzing cooperation between firms", September 1987.
87/34	Kasra FERDOWS and Arnoud DE MEYER	"European manufacturers: the dangers of complacency. Insights from the 1987 European manufacturing futures survey, October 1987.
87/35	P. J. LEDERER and J. F. THISSE	"Competitive location on networks under discriminatory pricing", September 1987.
87/36	Manfred KETS DE VRIES	"Prisoners of leadership", Revised version October 1987.
87/37	Landis GABEL	"Privatization: its motives and likely consequences", October 1987.
87/38	Susan SCHNEIDER	"Strategy formulation: the impact of national culture", October 1987.
87/39	Manfred KETS DE VRIES 1987	"The dark side of CEO succession", November
87/40	Carmen MATUTES and Pierre REGIBEAU	"Product compatibility and the scope of entry", November 1987
87/41	Gavriel HAVAVINI and Claude VIALLET	"Seasonality, size premium and the relationship between the risk and the return of French common stocks", November 1987
87/42	Damien NEVEN and Jacques-F. THISSE	"Combining horizontal and vertical differentiation: the principle of max-min differentiation", December 1987
87/43	Jean GABSZEVICZ and Jacques-F. THISSE	"Location", December 1987
87/44	Jonathan HAMILTON, Jacques-F. THISSE and Anita WESKAMP	"Spatial discrimination: Bertrand vs. Cournot in a model of location choice", December 1987
87/45	Karel COOL, David JEMISON and Ingemar DIERICKX	"Business strategy, market structure and risk-return relationships: a causal interpretation", December 1987.
87/46	Ingemar DIERICKX and Karel COOL	"Asset stock accumulation and sustainability of competitive advantage", December 1987.

<u>1988</u>

88/01	Michael LAWRENCE and Spyros MAKRIDAKIS	"Factors affecting judgemental forecasts and confidence intervals", January 1988.
88/02	Spyros MAKRIDAKIS	"Predicting recessions and other turning points", January 1988.
88/03	James TEBOUL	"De-industrialize service for quality", January 1988.
88/04	Susan SCHNEIDER	"National vs. corporate culture: implications for human resource management", January 1988.
88/05	Charles WYPLOSZ	"The swinging dollar: is Europe out of step?", January 1988.
88/06	Reinhard ANGELMAR	"Les conflits dans les canaux de distribution", January 1988.
88/07	Ingemar DIERICKX and Karel COOL	"Competitive advantage: a resource based perspective", January 1988.
88/08	Reinhard ANGELMAR and Susan SCHNEIDER	"Issues in the study of organizational cognition", February 1988.
88/09	Bernard SINCLAIR-DESGAGNé	"Price formation and product design through bidding", February 1988.
88/10	Bernard SINCLAIR-DESGAGNé	"The robustness of some standard auction game forms", February 1988.
88/11	Bernard SINCLAIR-DESGAGNé	"When stationary strategies are equilibrium bidding strategy: The single-crossing property", February 1988.

88/12	Spyros MAKRIDAKIS	"Business firms and managers in the 21st century", February 1988
88/13	Manfred KETS DE VRIES	"Alexithymia in organizational life: the organization man revisited", February 1988.
88/14	Alain NOEL	"The interpretation of strategies: a study of the impact of CEOs on the corporation", March 1988.
88/15	Anil DEOLALIKAR and Lars-Hendrik ROLLER	"The production of and returns from industrial innovation: an econometric analysis for a developing country", December 1987.
88/16	Gabriel HAVAWINI	"Market efficiency and equity pricing: international evidence and implications for global investing", March 1988.
88/17	Michael BURDA	"Monopolistic competition, costs of adjustment and the behavior of European employment", September 1987.
88/18	Michael BURDA	"Reflections on "Wait Unemployment" in Europe", November 1987, revised February 1988.
88/19	M.J. LAWRENCE and Spyros MAKRIDAKIS	"Individual bias in judgements of confidence", March 1988.
88/20	Jean DERMINE, Damien NEVEN and J.F. THISSE	"Portfolio selection by mutual funds, an equilibrium model", March 1988.
88/21	James TEBOUL	"De-industrialize service for quality", March 1988 (88/03 Revised).
88/22	Lars-Hendrik RÖLLER	"Proper Quadratic Functions with an Application to AT&T", May 1987 (Revised March 1988).
88/23	Sjur Didrik FLAM and Georges ZACCOUR	"Equilibres de Nash-Cournot dans le marché européen du gaz: un cas où les solutions en boucle ouverte et en feedback coïncident", Mars 1988
88/24	B. Espen ECKBO and Herwig LANGOHR	"Information disclosure, means of payment, and takeover premia. Public and Private tender offers in France", July 1985, Sixth revision, April 1988.
88/25	Everette S. GARDNER and Spyros MAKRIDAKIS	"The future of forecasting", April 1988.
88/26	Sjur Didrik FLAM and Georges ZACCOUR	"Semi-competitive Cournot equilibrium in multistage oligopolies", April 1988.
88/27	Murugappa KRISHNAN Lars-Hendrik RÖLLER	"Entry game with resalable capacity", April 1988.
88/28	Sumantra GHOSHAL and C. A. BARTLETT	"The multinational corporation as a network: perspectives from interorganizational theory", May 1988.
88/29	Naresh K. MALHOTRA, Christian PINSON and Arun K. JAIN	"Consumer cognitive complexity and the dimensionality of multidimensional scaling configurations", May 1988.
88/30	Catherine C. ECKEL and Theo VERMAELEN	"The financial fallout from Chernobyl: risk perceptions and regulatory response", May 1988.
88/31	Sumantra GHOSHAL and Christopher BARTLETT	"Creation, adoption, and diffusion of innovations by subsidiaries of multinational corporations", June 1988.
88/32	Kasra FERDOWS and David SACKRIDER	"International manufacturing: positioning plants for success", June 1988.
88/33	Mihkel M. TOMBAK	"The importance of flexibility in manufacturing", June 1988.
88/34	Mihkel M. TOMBAK	"Flexibility: an important dimension in manufacturing", June 1988.
88/35	Mihkel M. TOMBAK	"A strategic analysis of investment in flexible manufacturing systems", July 1988.
88/36	Vikas TIBREWALA and Bruce BUCHANAN	"A Predictive Test of the NBD Model that Controls for Non-stationarity", June 1988.
88/37	Murugappa KRISHNAN Lars-Hendrik RÖLLER	"Regulating Price-Liability Competition To Improve Welfare", July 1988.
88/38	Manfred KETS DE VRIES	"The Motivating Role of Envy : A Forgotten Factor in Management, April 88.
88/39	Manfred KETS DE VRIES	"The Leader as Mirror : Clinical Reflections", July 1988.
88/40	Josef LAKONISHOK and Theo VERMAELEN	"Anomalous price behavior around repurchase tender offers", August 1988.
88/41	Charles WYPLOSZ	"Assymetry in the EMS: intentional or systemic?", August 1988.
88/42	Paul EVANS	"Organizational development in the transnational enterprise", June 1988.
88/43	B. SINCLAIR-DESGAGNE	"Group decision support systems implement Bayesian rationality", September 1988.
88/44	Essam MAHMOUD and Spyros MAKRIDAKIS	"The state of the art and future directions in combining forecasts", September 198
88/45	Robert KORAJCZYK and Claude VIALLET	"An empirical investigation of international asset pricing", November 1986, revised August 1988.
88/46	Yves DOZ and Amy SHUEN	"From intent to outcome: a process framework for partnerships", August 1988.

88/47	Alain BULTEZ, Els GIJSBRECHTS, Philippe NAERT and Piet VANDEN ABEELE	"Asymmetric cannibalism between substitute items listed by retailers", September 1988.
88/48	Michael BURDA	"Reflections on 'Wait unemployment' in Europe, II", April 1988 revised September 1988.
88/49	Nathalie DIERKENS	"Information asymmetry and equity issues", September 1988.
88/50	Rob WEITZ and Arnoud DE MEYER	"Managing expert systems: from inception through updating", October 1987.
88/51	Rob WEITZ	"Technology, work, and the organization: the impact of expert systems", July 1988.
88/52	Susan SCHNEIDER and Reinhard ANGELMAR	"Cognition and organizational analysis: who's minding the store?", September 1988.
88/53	Manfred KETS DE VRIES	"Whatever happened to the philosopher-king: the leader's addiction to power, September 1988.
88/54	Lars-Hendrik RÖLLER and Mihkel M. TOMBAK	"Strategic choice of flexible production technologies and welfare implications", October 1988
88/55	Peter BOSSAERTS and Pierre HILLION	"Method of moments tests of contingent claims asset pricing models", October 1988.
88/56	Pierre HILLION	"Size-sorted portfolios and the violation of the random walk hypothesis: Additional empirical evidence and implication for tests of asset pricing models", June 1988.
88/57	Wilfried VANHONACKER and Lydia PRICE	"Data transferability: estimating the response effect of future events based on historical analogy", October 1988.
88/58	B. SINCLAIR-DESGAGNE and Mihkel M. TOMBAK	"Assessing economic inequality", November 1988.
88/59	Martin KILDUFF	"The interpersonal structure of decision making: a social comparison approach to organizational choice", November 1988.
88/60	Michael BURDA	"Is mismatch really the problem? Some estimates of the Chelwood Gate II model with US data", September 1988.
88/61	Lars-Hendrik RÖLLER	"Modelling cost structure: the Bell System revisited", November 1988.
88/62	Cynthia VAN HULLE, Theo VERMAELEN and Paul DE WOUTERS	"Regulation, taxes and the market for corporate control in Belgium", September 1988.
88/63	Fernando NASCIMENTO and Wilfried R. VANHONACKER	"Strategic pricing of differentiated consumer durables in a dynamic duopoly: a numerical analysis", October 1988.
88/64	Kasra FERDOWS	"Charting strategic roles for international factories", December 1988.
88/65	Arnoud DE MEYER and Kasra FERDOWS	"Quality up, technology down", October 1988.
88/66	Nathalie DIERKENS	"A discussion of exact measures of information assymetry: the example of Myers and Majluf model or the importance of the asset structure of the firm", December 1988.
88/67	Paul S. ADLER and Kasra FERDOWS	"The chief technology officer", December 1988.

1989

89/01	Joyce K. BYRER and Tawfik JELASSI	"The impact of language theories on DSS dialog", January 1989.
89/02	Louis A. LE BLANC and Tawfik JELASSI	"DSS software selection: a multiple criteria decision methodology", January 1989.
89/03	Beth H. JONES and Tawfik JELASSI	"Negotiation support: the effects of computer intervention and conflict level on bargaining outcome", January 1989.
89/04	Kasra FERDOWS and Arnoud DE MEYER	"Lasting improvement in manufacturing performance: In search of a new theory", January 1989.
89/05	Martin KILDUFF and Reinhard ANGELMAR	"Shared history or shared culture? The effects of time, culture, and performance on institutionalization in simulated organizations", January 1989.
89/06	Mihkel M. TOMBAK and B. SINCLAIR-DESGAGNE	"Coordinating manufacturing and business strategies: I", February 1989.
89/07	Damien J. NEVEN	"Structural adjustment in European retail banking. Some view from industrial organisation", January 1989.
89/08	Arnoud DE MEYER and Hellmut SCHÜTTE	"Trends in the development of technology and their effects on the production structure in the European Community", January 1989.
89/09	Damien NEVEN, Carmen MATUTES and Marcel CORSTJENS	"Brand proliferation and entry deterrence", February 1989.
89/10	Nathalie DIERKENS, Bruno GERARD and Pierre HILLION	"A market based approach to the valuation of the assets in place and the growth opportunities of the firm", December 1988.

89/11	Manfred KETS DE VRIES and Alain NOEL	"Understanding the leader-strategy interface: application of the strategic relationship interview method", February 1989.
89/12	Wilfried VANHONACKER	"Estimating dynamic response models when the data are subject to different temporal aggregation", January 1989.
89/13	Manfred KETS DE VRIES	"The impostor syndrome: a disquieting phenomenon in organizational life", February 1989.
89/14	Reinhard ANGELMAR	"Product innovation: a tool for competitive advantage", March 1989.
89/15	Reinhard ANGELMAR	"Evaluating a firm's product innovation performance", March 1989.
89/16	Wilfried VANHONACKER, Donald LEHMANN and Fareena SULTAN	"Combining related and sparse data in linear regression models", February 1989.
89/17	Gilles AMADO, Claude FAUCHEUX and André LAURENT	"Changement organisationnel et réalités culturelles: contrastes franco-américains", March 1989.
89/18	Srinivasan BALAK-RISHNAN and Mitchell KOZA	"Information asymmetry, market failure and joint-ventures: theory and evidence", March 1989
89/19	Wilfried VANHONACKER, Donald LEHMANN and Fareena SULTAN	"Combining related and sparse data in linear regression models", Revised March 1989
89/20	Wilfried VANHONACKER and Russell WINER	"A rational random behavior model of choice", Revised March 1989
89/21	Arnoud de MEYER and Kasra FERDOWS	"Influence of manufacturing improvement programmes on performance", April 1989
89/22	Manfred KETS DE VRIES and Sydney PERZOW	"What is the role of character in psychoanalysis? April 1989
89/23	Robert KORAJCZYK and Claude VIALLET	"Equity risk premia and the pricing of foreign exchange risk" April 1989
89/24	Martin KILDUFF and Mitchel ABOLAFIA	"The social destruction of reality: Organisational conflict as social drama" April 1989
89/25	Roger BETANCOURT and David GAUTSCHI	"Two essential characteristics of retail markets and their economic consequences" March 1989
89/26	Charles BEAN, Edmond MALINVAUD, Peter BERNHOLZ, Francesco GIAVAZZI and Charles WYPLOSZ	"Macroeconomic policies for 1992: the transition and after", April 1989
89/27	David KRACKHARDT and Martin KILDUFF	"Friendship patterns and cultural attributions: the control of organizational diversity", April 1989
89/28	Martin KILDUFF	"The interpersonal structure of decision making: a social comparison approach to organizational choice", Revised April 1989
89/29	Robert GOGEL and Jean-Claude LARRECHE	"The battlefield for 1992: product strength and geographic coverage", May 1989
89/30	Lars-Hendrik ROLLER and Mihkel M. TOMBAK	"Competition and Investment in Flexible Technologies", May 1989